

## REPORT DOCUMENTATION PAGE

AFRL-SR-BL-TR-01-

Public reporting burden for this collection of information is estimated to average 1 hour per response, including gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Infrastructure, Division of采办, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project 0704-0188, Washington, DC 20503.

0573

ces,  
this  
erson

1. AGENCY USE ONLY (Leave blank)			2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
			01 Apr 00 to 31 Mar 01 Final	
4. TITLE AND SUBTITLE			5. FUNDING NUMBERS	
(DURIP00) Instrumentation for advanced source development at 95GHz			61103D 3484/US	
6. AUTHOR(S)				
Dr Kreischer				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)			8. PERFORMING ORGANIZATION REPORT NUMBER	
MIT 77 Massachusetts Avenue Cambridge, MA 02139-4307				
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
AFOSR/NE 801 North Randolph Street Rm 732 Arlington, VA 22203-1977			F49620-00-1-0277	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION AVAILABILITY STATEMENT			12b. DISTRIBUTION CODE	
APPROVAL FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED			AIR FORCE OFFICE OF SCIENTIFIC RESEARCH (AFOSR) NOTICE OF TRANSMITTAL DTIC. THIS TECHNICAL REPORT HAS BEEN REVIEWED AND IS APPROVED FOR PUBLIC RELEASE LAW AFR 190-12. DISTRIBUTION IS UNLIMITED	
13. ABSTRACT (Maximum 200 words)				
<p>MIT purchased a 95 GHz extended interaction oscillator (EIO) and power supply from CPI, Inc. The EIO was specified so that it generates about 1 kW of peak power, operates at up to 1% duty, and has a 2 GHz mechanical tuning range. This instrumentation significantly enhances the educational experience of those graduate students participating in the vacuum electronics MURI.</p> <p style="text-align: right;">20011126 069</p>				
14. SUBJECT TERMS			15. NUMBER OF PAGES	
17. SECURITY CLASSIFICATION OF REPORT			18. SECURITY CLASSIFICATION OF THIS PAGE	
UNCLASSIFIED			UNCLASSIFIED	
19. SECURITY CLASSIFICATION OF ABSTRACT			20. LIMITATION OF ABSTRACT	
UNCLASSIFIED			UL	

## **Final Report**

### **DURIP Instrumentation for Advanced Source Development at 95 GHz**

**Sponsor: 000106: Air Force Aerospace Research – OSR**  
**Award number: F49620-00-1-0277**

**MIT Account number: 6890631**  
**MIT Award Number: 007245-001**

**Funding: \$145,000**

**April 1, 2000 – March 31, 2001**

**Date of this Final Report: October, 2001**

#### **Final Report Prepared by:**

Richard Temkin  
MIT Plasma Science and Fusion Center  
MIT Building NW16  
167 Albany St.  
Cambridge, MA 02139  
Tel: 617-253-5528  
Fax: 617-253-6078  
Email: [temkin@psfc.mit.edu](mailto:temkin@psfc.mit.edu)

## **Project Summary**

MIT proposed to acquire a W-Band (95 GHz) source for use as a driver for advanced amplifier research under the funded DURIP program. This instrumentation is critically needed for testing innovative amplifiers that are currently being fabricated and assembled at MIT. The DURIP equipment will be used as part of the Innovative Vacuum Electronics research program at MIT. MIT, as part of that consortium, is investigating novel high frequency amplifiers at W-Band, such as wide-band gyroamplifiers and devices using photonic bandgap structures. We are also developing quasi-optical antennas and mode transformers for use with these amplifiers.

MIT purchased a 95 GHz extended interaction oscillator (EIO) and power supply from CPI, Inc. The EIO was specified so that it generates about 1 kW of peak power, operates at up to 1% duty, and has a 2 GHz mechanical tuning range. This instrumentation significantly enhances the educational experience of those graduate students participating in the vacuum electronics MURI. As a driver, it allows students to investigate the gain of advanced amplifiers at high output powers. As part of a cold testing facility, it provides significantly enhanced dynamic range in measurements of microwave structures. This results in a better comparison with electromagnetic models. Finally, it allows us to train our students in the proper use of high power microwave instrumentation.

### **95 GHz EIO**

Under the DURIP award, we purchased a pulsed extended interaction klystron amplifier from Communication & Power Industries (CPI), Inc. The model number is VKB244506 and the serial number is E0876B1. The EIO and power supply together constitute a transmitter. The transmitter is a model VPW3493-03, S/N002.

The EIO met specifications across the band. The measured results at the factory are listed in the Table.

**Table: EIO Test Results**

<b>Test Frequency (GHz)</b>	<b>RF Output Power (W, Peak)</b>
90.7	988
91.0	1250
92.0	1700
93.0	1830
93.5	1830
94.0	1630
94.5	1166
95.0	1560
95.7	2350

The Table results indicate that the EIO has put out the specified 1 kW of power over the entire band from 93.0 to 95.0 GHz. The output power was in fact substantial over a frequency bandwidth of 5 GHz, much larger than the specified 2 GHz bandwidth.

### **EIO Installation and Testing**

After receipt at the MIT Plasma Science and Fusion Center, the EIO was set up for testing on a lab bench. The output power was measured with a power meter and found to agree with the powers listed in the Table above. To this date, October, 2001, the EIO has operated in a satisfactory manner with no problems. The EIO is therefore considered to be accepted as delivered. We intend to use the EIO as the driver in upcoming experiments at 95 GHz.